

CLAIMS

What is claimed is:

- 1 1. A method for applying changes in redo records to make a particular
2 resource reflect changes made to the particular resource in volatile
3 memory before a failure, the method comprising the steps of:
4 establishing links that link together a set of redo records that contain
5 changes made to the particular resource; and
6 following the links to apply the changes contained in the set of redo
7 records to cause the particular resource to reflect the changes made
8 to the particular resource in volatile memory before the failure.

- 1 2. The method of Claim 1, wherein the step of establishing links that link
2 together the set of redo records is performed prior to the failure.

- 1 3. The method of Claim 1, wherein the step of following the links to apply
2 the changes contained in the set of redo records is performed in response
3 to a transaction requesting access to the particular resource subsequent to
4 the failure.

- 1 4. A method for applying changes in redo records to make a resource
2 available, wherein the resource is locked by a dead transaction, the method
3 comprising the steps of:
4 (A) identifying a redo record in a block-base redo chain, wherein the redo
5 record contains least recent changes that need to be applied to the
6 resource;

(B) applying the least recent changes contained in the redo record to the resource; and

(C) repeating steps (A) and (B) until all changes that are contained in redo records in the block-base redo chain have been applied to the resource.

- 1 6. The method of Claim 5, further comprising establishing the plurality of sets
- 2 of undo records by performing steps that comprise:
- 3 among the plurality of sets of undo records:
 - 4 assigning all undo records that are associated with a first
 - 5 resource to a first set of undo records; and
 - 6 assigning all undo records that are associated with a
 - 7 second resource to a second set of undo records.

1 7. The method of Claim 6, wherein:

2 the step of assigning all undo records that are associated with the first
3 resource includes the step of linking in a first chain undo records
4 that contain changes that are associated with the first resource; and
5 the step of assigning all undo records that are associated with the second
6 resource includes the step of linking in a second chain undo records
7 that contain changes that are associated with the second resource.

1 8. The method of Claim 7, wherein:
2 the step of linking in the first chain undo records that contain changes that
3 are associated with the first resource includes the step of generating
4 a first block-based undo chain, wherein the first block-based undo
5 chain contains undo records that contain changes that need to be
6 applied to the first resource; and
7 the step of linking in the second chain undo records that contain changes
8 that are associated with the second resource includes the step of
9 generating a second block-based undo chain, wherein the second
10 block-based undo chain contains undo records that contain changes
11 that need to be applied to the second resource.

1 9. A method for linking undo records, the method comprising the steps of:
2 identifying an undo record, wherein the undo record contains change
3 information that is associated with a particular resource;
4 linking the undo record into an undo record chain, wherein the undo record
5 chain contains only undo records that contain change information
6 that is associated with the particular resource; and

7 wherein the step of linking the undo record includes generating identifying
8 data in at least one of the records in the undo record chain or in the
9 undo record, wherein said identifying data once generated identifies
10 a particular record in the undo record chain.

1 10. The method of claim 9, wherein:
2 the step of identifying the undo record includes the step of identifying an
3 undo record that contains change information that is associated with
4 a particular data block; and
5 the step of linking the undo record into the undo record chain, includes the
6 step of linking the undo record into the undo record chain, wherein
7 the undo record chain contains only undo records that contain
8 change information that is associated with the particular data block.

1 11. The method of claim 9, further comprising the steps of:
2 identifying a first undo record, wherein relative to the undo record chain the
3 first undo record contains the least recent change information that
4 needs to be applied to the particular resource; and
5 linking a pointer in the first undo record to the undo record chain.

1 12. The method of claim 9, further comprising the steps of:
2 identifying a last undo record, wherein relative to the undo record chain the
3 last undo record contains the most recent change information that
4 needs to be applied to the particular resource; and
5 linking a pointer in the last undo record to the undo record chain.

- 1 13. The method of claim 9, wherein the undo record chain contains only undo
- 2 records that contain change information that needs to be applied to the
- 3 particular resource.

- 1 14. A method for recovering after failure of a transaction, the method
- 2 comprising the step of:
- 3 prior to said failure, storing in a first recovery record data that reflects a first
- 4 change made by the transaction to a first resource;
- 5 after making said first change and prior to said failure, storing in a second
- 6 recovery record data that reflects a second change by the transaction
- 7 to a second resource;
- 8 after making said second change and prior to said failure, storing in a third
- 9 recovery record data that reflects a third change to said first
- 10 resource;
- 11 after said failure, recovering said transaction; and
- 12 wherein the step of recovering said transaction includes applying said data
- 13 in said first recovery record and said data in said third recovery
- 14 record prior to applying said data in said second recovery record.

- 1 15. The method of claim 14, wherein:
 - 2 the step of storing in a first recovery record comprises the step of storing in
 - 3 a first undo record;
 - 4 the step of storing in a second recovery record comprises the step of storing
 - 5 in a second undo record;

6 the step of storing in a third recovery record comprises the step of storing in
7 a third undo record; and
8 the step of applying said data comprises the step of applying said
9 data in said first undo record and said data in said third
10 undo record prior to applying said data in said second
11 undo record.

1 16. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 1.

1 17. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 2.

1 18. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 3.

1 19. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 4.

1 20. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 5.

1 21. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 6.

1 22. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 7.

1 23. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 8.

1 24. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 9.

- 1 25. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 10.

- 1 26. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 11.

- 1 27. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 12.

- 1 28. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 13.

- 1 29. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 14.

1 30. A computer-readable medium carrying one or more sequences of
2 instructions which, when executed by one or more processors,
3 causes the one or more processors to perform the method recited
4 in Claim 15.